APPENDIX

Fuel Models For Estimating Fire Behavior

(Anderson, Hal E. 1982 General Technical Report INT-122, USDA,
Ogden Intermountain Range and Experimentation Station)

Fuel Model 1: This model is used for short (generally below knee level or about 1-foot tall) fine-textured pure grass which best represents typical grasslands and savannas. Less than one-third of the area has other vegetation like shrubs or trees. Fuel loading in fuel model 1 range from ½ to ¾ of a ton per acre. Fires in fuel model 1 burn rapidly with flame lengths averaging 4 feet.

Fuel Model 2: Like fuel model 1, fuel model 2 is dominated by grass about 1 to 2-feet tall, usually under an open wooded or timber over-story. The larger particle size in these shrubs and the litter from the tree over-story increases intensity, but reduces fire spread. Four to five tons of fuel is found per acre and the fuel bed depth is 1-2 feet.

Fuel Model 4: This is a brush model and is characterized by stands of mature brush 6 feet or more in height with continuous, inter-linking crowns, and ranging from 15 to 80 tons per acre. Fires in this fuel model burn intensely (50+ foot flame lengths) and spread relatively quickly.

Fuel Model 5: Fuel model 5 is composed of the same mixes of vegetation as
Fuel Model 4, but individual plants are shorter, usually sparser, and less mature with little or no dead component. This model occurs on poor sites, on recent burns and may occur under tree over-stories. Fires in this fuel type do not burn as intense (6-13 foot flame lengths), or as rapidly due to higher concentrations of live to dead fuel.

Fuel Model 6: This fuel model consists of vegetation that is taller and more flammable than that of fuel model 5, but not as tall or as dense as fuel model 4.Fires in this model will burn in the foliage of standing vegetation, but only when wind speeds are greater than 8 mph. Fires burn with an average flame length of 6 feet and spread at a rate of 2,112 feet/hour. Interior live oak, young chamise and manzanita are all associated with this fuel model. In many instances a fuel model 5 will evolve into a fuel model 6 by the latter part of summer.

Fuel Model 8: This model reflects slow burning, low intensity fires burning in the leaf or needle litter under a conifer or hardwood canopy. Fuel model 8
contains few fine fuels (about 1-2 tons per acre) consisting of compacted leaf and short needle conifer litter and is absent an under story shrub layer. These fires do not pose a threat unless low fuel moisture or high winds allow the fire to spread into the canopy. This model is found locally in areas treated for fuel reduction. It represents the ideal model; where fire behavior is characterized by low-intensity, slow burning ground fire.

Fuel Model 9: Much like fuel model 8 this model has little or no shrub layer but has more fine fuels (about 2-4 tons per acre), which is deeper, and “fluffier” like oak leaves and long conifer needles. Fires in this model also burn with more intensely and higher rates of spread especially under windy conditions. This model is found in a wide range of areas under timber stands which have been treated for fuel reduction, or have seen low intensity fires over the last decade.. Surface fire flame lengths, without the affects of wind or slope, range from 3 to 7 feet.

Fuel Model 10: Fuel model 10 almost always has a shrub or immature tree under story with loadings of fine fuels of about 3 to 4 tons per acre and heavy loadings of 12+ tons per acre. Fires in this timber model burn with greater intensity (6-10 foot flame lengths) with moderate rates of spread. Torching of individual trees is common and can cause embers to start new "spot" fires ahead of the main fire. Crown fires are also a threat in this fuel type. In dry conditions, or with high winds, fires in fuel model 10 can be very difficult to control. This model is characterized by stands of overstocked, unmanaged natural conifer stands.